

## SIMILARITIES IN LATENT STRUCTURES IN MOTOR SPACE OBTAINED WITH LONGITUDINAL APPROACH AT 6 AND 7 YEAR OLD CHILDREN

UDC:796.012.1-053.4  
(Original scientific paper)

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### Abstract

*The research was realized using 33 motor tests for estimation of 9 motor abilities, measured in 246 examiners, 6 and 7 year old children, tested longitudinally in two periods of time. Using factor analysis 10 latent dimensions were isolated for age groups, 6 and 7 years old children. The similarity between both age groups was determined using coefficients of congruence. The values of applied coefficient of congruence were significant only for the factors named as factor for coordinative explosive movements isolated at 6 year old children and the factor repetitive strength isolated at 7 year old children. The rest of the coefficients of congruence are not significant. This means that at the same group of children, tested in different periods, different motor abilities exist. Obtained results point out presence and influence of the component of development, which indicates the need of application and practical realization of different movement tasks, as well as a different approach in educational work with children in every age period.*

**Key words:** congruence, motor abilities, 6 and 7 year old children, factor structure.

### INTRODUCTION

Respecting individual possibilities of each child, respectively adaptation of educational contents on children's permanent possibilities and needs, are one of the basic principles in educational work with children, especially in the physical education teaching process (Conception for a nine-year compulsory education).

Using these principles as a basis in educational work, acquisition of children's motor abilities in every particular age period, as well as the similarities and differences of motor abilities and their manifestation and development is especially important for the PE teaching process. This is especially important from the aspect of PE issues and tasks and their determination by the development changes in terms of how to use children abilities and their previous knowledge in the further teaching activities with aim of their improvement and enrichment in the following teaching stages. This especially concerns the educational tasks that are mainly conditioned and are in relation with the level of development of motor abilities (Matić, 1978; Klincarov & Popeska, 2011; Racev,

2009). Therefore, children's motor abilities established by determination of the structure of motor space in every age period, as well as the similarities and differences in their manifestation are especially important for pedagogic work with children. They are also very important for proper definition of issues and tasks, as well as the selection of appropriate approach in realization of PE contents realized during the PE teaching process.

The structure of motor space in children in early school period - pupils in the first cycle of nine-year compulsory education is rarely examined issue in our country (Dukovski, 1984; Popeska, 2009, 2011). Lately, there is a notable tendency of greater interest among researchers. The results from mentioned researches as well as the results from other similar researches (Bala, 1981, 2002; Rajtmajer & Proje, 1990; Perič, 1999; Rausavljevič, 1992; Strel & Šturm, 1981; Rajtmajer, 1993, 1997; Pišot & Planinšec, 2005) point out that the structure of motor space in children is not clearly defined and is conditioned by the age of the examiners.

These findings point out to the development

concept, which emphasizes that motor development, determined by the “determination of development order” instead of the chronological age (Herloheva, 1970; Piaget, 1960; Smiljanić – Tolić, 1983). Apart from this concept, the need of knowledge for development possibilities in every age period is emphasized, as well as the need of longitudinal studies of children’s motor abilities in order to determine the development component. This is particularly important for the early school period when development changes are especially intensive and continuous (Haywood et al, 2004; Jürimäe, T. & Jürimäe, J, 2001; Malina et al 2004). In these sense, the physical education contents realized at PE classes have a great influence on children’s motor development. On the other hand, the domain of motor development is highly related and has a huge impact on other development domains – cognitive and socio – emotional. (Malina, Bouchard & Bar – Om, 2004).

Considering relations between the age period and motor abilities in children, the aim of this paper is to fortify the similarities of determined structure of motor space at same group of children. The examiners were followed longitudinally, in two time and age points, at the age of six in the initial measurement, and a year later, at the age of seven in the final measurement.

## METHOD OF WORK

For the purpose of comparing the structures of motor spaces in the same group of children at the age of six and lately at the age of seven year olds, we conducted a research with longitudinal character, realized on a sample of 246 examiners, first and second grade pupils in five primary schools in Skopje, Republic of Macedonia. The initial measurement was realized to the sample of 123 six year old male children and the equal number of children was measured a year later as a seven year old children.

The examinees were tested in 33 motor tests, used for estimation on nine motor abilities, particularly, 4 motor tests used for estimation of coordination, explosive and repetitive strength, 3 movement tasks used for estimation of running speed, frequency of movement, static strength, balance and flexibility and five motor tasks for evaluation of preciseness.

Motor tests used in this research have a hypothetical character and are created according to the

motor structure in older examiners, using the structure model proposed by Metikoš, D., Prot, F., Hofman, E., Pintar, Z., Oreb, G. (1989). This approach is used in other numerous researches with same or similar subject of research (Strel & Šturm, 1981; ДУКОВСКИ, 1984; Rajtmajer & Proje, 1990; Rajtmajer, D, 1993, 1997; Pisot & Planinsec, 2005). Findings and recommendations of previous mentioned researchers are implemented in research procedure (Bala, 1981, 1999; Perić, D. 1991; Dukovski, 1984; Rajtmajer & Proje, 1990; Pisot, 1999; Zurc, Pišot & Strojnik, 2005; Popeska, 2009, 2011).

The structure and demands in movement tasks similar with contents in PE curricula, children’s age and possibilities, results of previous researches and recommendations of researchers that previously explored this issue with children in pre – school and early school age period were used as a criteria for selection of motor tests.

The structure of motor space at 6 year old children (initial measurement) and at 7 year old children (final measurement) is determined in previous research using factor analysis – Promax procedure. The similarities between the structures of motor space at the examiners in both researched periods are determined using the coefficient of congruence.

## RESULTS AND DISCUSSION

The motor spaces of six and seven year old children (examiners in initial and final measurement) were defined with 10 latent dimensions isolated separately for both age groups. All isolated factor are defined according to the number and the value of the significant projections of 33 applied motor tests.

The motor structure of 6 year old children is defined by the following factors: general speed, coordinated and explosive movements, factor for realization of fast front movements with legs, static balance, strength of the front part of the trunk, arms and shoulders, preciseness with leading, flexibility, strength of the back part of the trunk, arms and shoulders, preciseness with throwing and one undefined factor. Factors named as: preciseness with throwing objects with hand, speed with change of direction, static strength, factor for precise and explosive movements, coordinated fast movements, repetitive strength, balance and two undefined factors were isolated in the final measurement realized with 7-year old children.

*Table (1) Coefficients of congruention between motor factors obtained at 6 and seven years old children.*

	MF 1-7	MF 2-7	MF 3-7	MF 4-7	MF 5-7	MF 6-7	MF 7-7	MF 8-7	MF 9-7	MF 10-7
MF1-6	.66	-.05	-.43	-.18	.46	-.45	-.62	-.70	-.62	.09
MF2-6	-.39	.18	-.20	.29	-.21	.80	.24	.29	.28	-.27
MF3-6	.29	.12	-.08	-.21	.40	-.26	-.52	-.40	-.25	.02
MF4-6	-.72	.56	-.08	.28	-.47	.55	.24	.39	.41	-.15
MF5-6	.14	.02	.38	-.02	.22	-.16	-.34	-.23	-.38	.03
MF6-6	-.23	.08	.32	.04	-.21	.20	.24	.21	.06	.25
MF7-6	.65	-.11	.06	-.73	.54	-.56	-.45	-.48	-.42	.11
MF8-6	.70	-.23	.06	-.35	.68	-.56	-.62	-.51	-.44	.36
MF9-6	.59	-.03	-.25	-.08	.35	-.38	-.53	-.31	-.29	-.17
MF10-6	.43	-.18	-.04	-.25	.63	-.30	-.29	-.18	-.63	-.16

Results obtained with calculation of coefficients of congruention are presented in Table1. Coefficients higher than 0.80 are considered as significant.

Based on results for coefficients of congruention between isolated factors in both researched period and groups presented in Table 1, significant coefficient (.80) was obtained between the F2 defined as factor for coordinative explosive movements isolated at 6 years old children and the F6 named as factor for repetitive strength, isolated at 7 years old children. This result suggests the similarity between these two factors.

The similarities between these two factors could be noted from the significant projections of tests for estimation of explosive strength on F2 at 6 year old children (standing broad jump ESSDM, throwing medicine ball 1 kg from standing position ESFMST and throwing medicine ball 1 kg from sitting position ESFMG) and tests for estimation of repetitive strength (modified pushups RSSKL, sit-ups RSPTR, trunk lift PSITR) and the test for estimation of static strength horizontal hold lying on back SSZLG.

The starting position of the tests for estimation of explosive strength (standing broad jump ESSDM, throwing medicine ball 1 kg from standing position ESFMST and throwing medicine ball 1 kg from sitting position ESFMG) is one of the explanations for obtained similarities between two factors. Namely, at these three movement tasks, in the starting position of the movement, muscles of the trunk are prepared to work with isometric contraction that in the following phases of the movement allows fast movements with arms when throwing the medicine ball and fast movement

with legs when performing the standing broad jump. All this allows achievements of better results in listed tests. The participation of static and repetitive strength in the performance of the tests for estimation of explosive strength, leads to determined similarities obtained between F2 in the initial measurement and F6 in the final measurement, defined only by the tests for repetitive and static strength of the arms and the trunk.

These characteristics, as well as the fact that explosive, repetitive and static strength are controlled by the same mechanism – the mechanism for energetic regulation logical explains the similarity between these two factors (F2 and F6). Similar results are obtained in the research of Popeska (2010) and Popeska et al (2010) realized with different groups of six and seven years old examiners, followed in transversal study in same time. Results from these researches suggest on different structure of motor space, while values below the level of significance of the coefficient of congruention (.73 and .79) are obtained at factors determined by tests for estimation of coordination, explosive and repetitive strength and running speed as well as the similarity obtained between two factors named as explosive strength.

The participation of the tests for estimation of coordination (obstacle course backwards KOPON, two balls slalom rolling KOSL2 and rolling with ball on floor KOTRT) in determination of F2 isolated at 6 year old children could be explained with the fact that every explosive movement, especially with certain strain, as the case of the tests for explosive strength (medicine ball) should be coordinated, with synchronized movements of involved body parts (arms, legs and trunk).

According the findings of the author Bala (1981) who have also researched this problem, the tests standing broad jump, although in adults used as a test for estimation of explosive strength, for children this test is difficult to perform because it requires certain coordination capabilities in order to perform synchronized movements with legs, arms and trunk.

Values obtained for other coefficients of congruence are lower than 0.80 and are below the level of significance. This means that there is no similarity between other isolated factors in both researched periods, or that there is a different structure of motor space at the same group of examiners, followed at the age of six, and a year later, as seven years old children. These results suggest that the growth and development cause changes that have certain implications and influence toward motor abilities manifested differently in both studied age groups.

## CONCLUSION

Based on the results from the coefficients for congruence, we could conclude that similarity between the latent structures of the motor spaces at the same group of 6 and 7 year old children, exist only between two factors: F2 named as factor for coordinated and explosive movements isolated at 6 year old children and F6 named as factor for repetitive strength isolated at 7 year old children. Values of the coefficients of congruence between other factors are not significant. This means that the structure of motor space at the same group of 6 and 7 year old children is different and is presented with different motor abilities.

Similarity obtained between F2 and F6 could be explained with relations to the tests that have significant projections of these factors, or the tests for estimation of coordination, explosive and repetitive strength. The mechanism for energetic regulation responsible for control of the explosive, repetitive and static strength, explains the connection between tests for explosive and repetitive strength. The results from the previous researches (Popeska, 2009; Popeska et al, 2010), noted the mechanism for energetic regulation as an integrative factor for similarities in the structure of motor space at 6 and 7 years old children.

Relations with coordination could be explained with characteristics of coordination as a complex motor ability. When it refers to small children, coordination is an ability needed as a fundament for manifestation of other motor abilities, mostly at the strength, speed, balance and preciseness. In this relation is the note of Bala (1999) that tests applied for estimation of some other motor ability in adults (speed, explosive strength etc), with children could be used as tests for estimation of coordination. This means that certain movement tasks with complex motor structure applied to children, if not synchronized and coordinated, could not allow complete manifestation of abilities they are applied for.

Different structure of motor space at the same group of examiners followed at the age of six and seven years, suggest the development changes that occurs during a period of one year. In the same time, these also suggest the need of respecting and considering these differences in educational work with children, especially in the process of PE.

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## СЛИЧНОСТИ ВО ЛАТЕНТНИТЕ СТРУКТУРИ НА МОТОРИЧКИОТ ПРОСТОР ДОБИЕНИ СО ЛОНГИТУДИНАЛЕН ПРИСТАП КАЈ ДЕЦАНА 6 И НА 7 ГОДИШНА ВОЗРАСТ

УДК:796.012.1-053.4

(Оригинален научен труд)

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### Абстракт

Со примена на 33 моторички тестови за проценка на 9 моторички способности применети кај 246 испитаници, деца на 6 и на 7 годишна возраст, применети лонгитудинално во две временски точки, со примена на факторска анализа изолирани се 10 латентни димензии кај децата на 6 - годишна возраст и 10 латентни димензии кај децата на 7-годишна возраст. Сличноста меѓу изолираните фактори во двете возрастни групи е утврдена со пресметување на коефициент на конгруенција. Значаен коефициент на конгруенција е добиен единствено меѓу факторите именувани како фактор за координирани експлозивни движења кај децата од 6 години и фактор за рејитивна снага кај изолиран кај 7 годишните деца. Особено коефициентот на конгруенција се незначајни, што значи дека кај истата група деца во различни временски точки егзистираат различни моторички способности. Добитите резултати укажува на присуството и влијание на развојните компетенции, што иницира потреба од диференцирани задачи и различен пристап во В - О работата со децата во секој возрасен период.

**Клучни зборови:** конгруенција, моторички способности, деца 6 и 7 годишна возраст, факторска структура